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(54) Valve for delivering fluids

(57) A valve is made of a resilient material and comprises a housing (1) and at least two closure elements (11) defining an openable slit 13. The housing 1 is closed around its periphery to define a fluid flow path from an inlet 3 and through slit 13 when open. The elements (11) are secured to housing 1 in the region of its inner surface and abut each other in a closed position of the valve, the elements (11) extending in the closed position over at least a portion of each element 11 in a direction counter to the intended direction of flow A of fluid through the valve. On urging spaced peripheral portions of housing (1) towards each other, the housing 1 is caused to deform resiliently and to move elements (11) over at least a portion of each element 11 in a direction counter to direction A thereby causing elements (11) to become spaced from each other and to allow fluid to pass through the open slit 13. Protrusions 7 allow orientation of slit 13 to extend between upper and lower teeth of user.

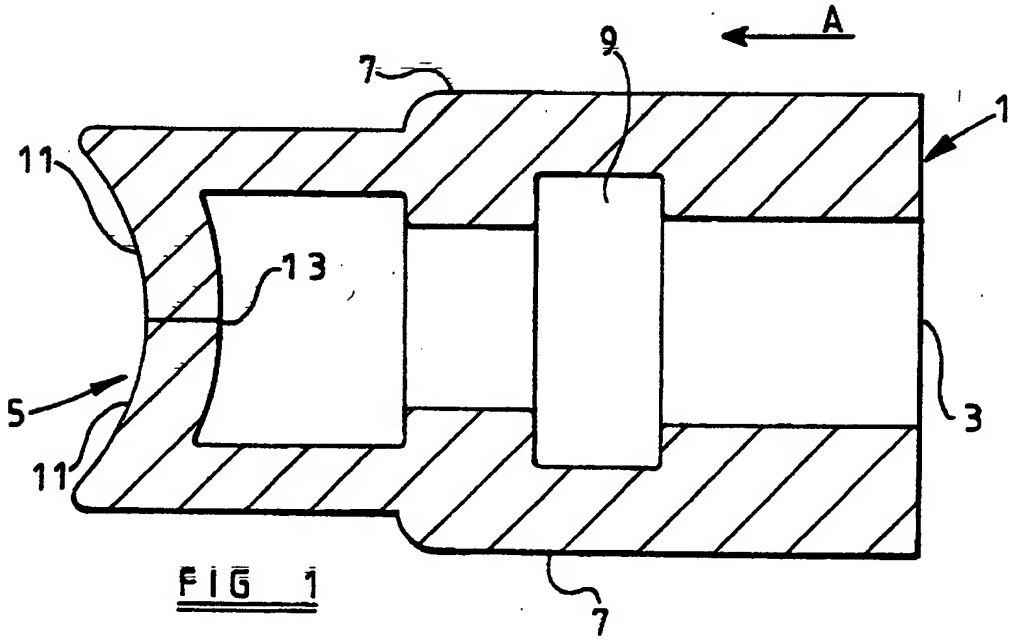

FIG 1

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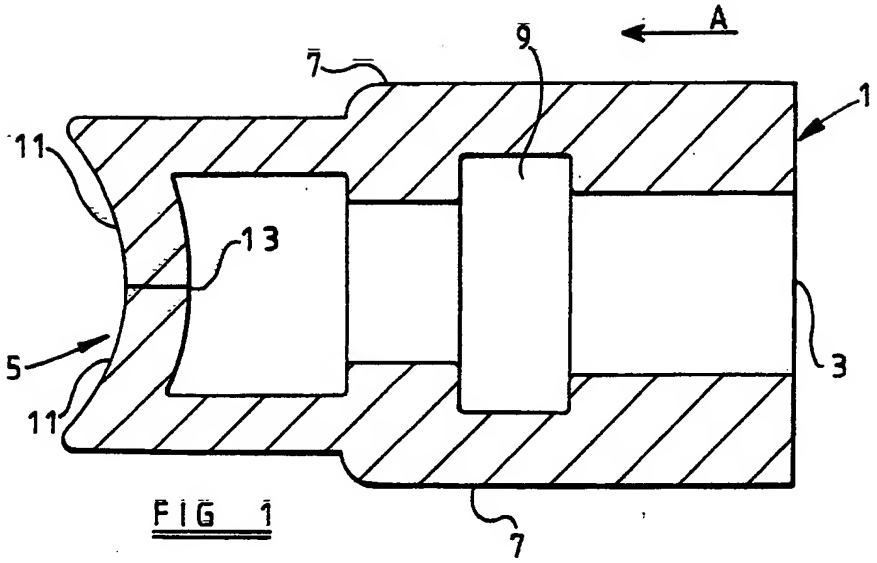

FIG 1

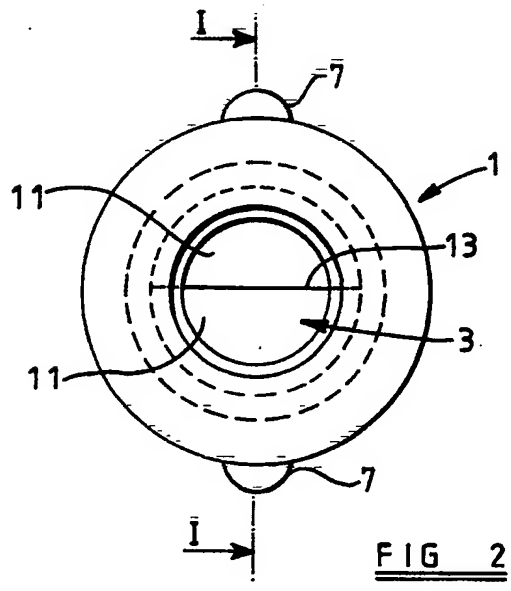

FIG 2

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VALVE FOR FLUID DELIVERY SYSTEM

The present invention relates to a valve for a fluid delivery system. The valve may be used, for example, in liquid delivery systems for use by athletes such as that described in my co-pending United Kingdom Patent Application No. 9300135.2, or in liquid delivery systems for use in medical applications or for use by disabled persons.

Valves for fluid delivery systems suffer problems in a number of ways. Valves which employ discrete internal components such as that described in United States Patent No. 5,060,833 are difficult to maintain in a sufficiently clean and hygienic condition, while valves which are moulded as a single integral component tend to leak progressively as the fluid pressure rises.

It is therefore an object of the present invention to provide a valve for a fluid delivery system that can be moulded as a single integral component and which is resistant to leakage.

According to the present invention there is provided a valve made of a resilient material, the valve comprising a valve housing and at least two valve closure elements, wherein:

the valve housing is closed around the periphery thereof so as to define a flow path through which fluid passes through the valve;

the valve closure elements are secured to the valve housing in the region of the inner surface thereof and abut against each other in a closed position of the valve, the valve closure elements extending in the closed position of the valve over at least a portion of each valve closure element in a direction counter to the intended direction of flow of fluid through the valve,

the arrangement being such that on urging spaced peripheral portions of the valve housing towards each other, the valve housing is caused to deform resiliently and to move the valve closure elements over at least a portion of each valve closure element in a direction counter to the intended direction of flow of fluid through the valve, thereby causing the valve closure elements to become spaced from each other and to allow fluid to pass through the valve.

The valve housing may be cylindrical. In such an embodiment, the valve closure elements may be positioned at or towards that end of the cylindrical housing remote from the intended fluid inlet thereof. The housing may be provided internally thereof with an annular recess for receiving an external collar of a fluid delivery tube. The

valve housing may have a relatively thin wall thickness in the region of that end of the housing remote from the intended fluid inlet thereof compared with the wall thickness of the housing in the region of that end thereof adjacent to the intended fluid inlet thereof.

The valve housing may be provided with protrusions to assist alignment of the valve. Two diametrically opposed protrusions may be provided. Where the valve housing extends significantly in the intended direction of fluid flow, the protrusions may be spaced from that end of the housing remote from the intended fluid inlet thereof.

Two valve closure elements may be provided. Each valve closure element may be substantially semi-circular in section and may be secure to the inner surface of the housing around the curved periphery of each valve closure element. Where protrusions are provided, the protrusions may be arranged such that they lie along a line substantially perpendicular to the straight line between the two valve closure elements.

The valve closure elements together may form part of a conic surface, for example, the valve closure elements may together form part of a sphere.

For a better understanding of the present invention and to show more clearly how it may be carried into effect

reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is a cross-sectional view of one embodiment of a valve according to the present invention taken along the line I-I in Figure 2; and

Figure 2 is an elevational view of the valve shown in Figure 1, looking in the direction of the arrow A shown in Figure 1.

The valve shown in Figures 1 and 2 comprises a housing in the form of a generally annular mouthpiece 1 which is open at one end 3 and closed at the other end 5 thereof. Extending along diametrically opposed outer surfaces of the mouthpiece 1 from a point spaced from the closed end 5 thereof substantially to the open end 3 are two protrusions 7. The protrusions 7 are generally part-circular in cross-section and serve to facilitate orientation of the mouthpiece in the mouth of the user or to otherwise indicate to the user the desired orientation of the valve for use as will be described in more detail hereinafter.

The wall thickness of the mouthpiece 1 in the region of the open end 3, that is in the region of the intended fluid inlet, is greater than the wall thickness thereof in the region of the closed end 5. The portion of the mouthpiece having the lesser wall thickness is therefore relatively

more flexible than the portion having the greater wall thickness.

Provided internally of the mouthpiece 1 in that portion of the mouthpiece having the greater wall thickness is an annular recess 9. In use of the mouthpiece 1, a fluid delivery tube (not shown) having an external collar at the free end thereof extends into the open end 3 of the mouthpiece with the external collar engaging in the annular recess 9 of the mouthpiece.

The closed end of the mouthpiece 1 is in the form of a plurality of inwardly directed valve closure elements 11. In the illustrated embodiment, the inward direction is counter to the direction of the arrow A in Figure 1. In the illustrated embodiment, the inward direction of the valve closure elements is achieved by forming the valve closure elements 11 in the form of a part-spherical surface, but alternative conic or other inwardly directed forms are also possible. Two valve closure elements 11 are provided in the illustrated embodiment, although a greater number may be provided if desired, the two valve closure elements being configured such that they abut against each other to form a slit 13 extending along a straight line which is substantially perpendicular to a diametral line joining the two protrusions 7. Additionally, the abutting surfaces of the two valve closure elements are configured such that they abut against each other substantially

throughout the thickness of the elements in the axial direction of the mouthpiece.

The mouthpiece 1 is made as a single integral moulding from a resilient material such as a silicone rubber material.

In operation, the mouthpiece 1 is mounted on the end of a fluid delivery tube which incorporates an external collar, the external collar engaging in the annular recess 9 of the mouthpiece as described hereinabove. The fluid delivery tube in turn communicates with a reservoir of fluid, such as water, for example as described in my co-pending United Kingdom Patent Application No. 9300135.2.

Fluid is supplied to the user by the user taking the mouthpiece 1 into his mouth and orienting the mouthpiece, with the aid of the two protrusions 7, such that the slit extends substantially between the upper and lower teeth of the user. The user can then bite upon the mouthpiece in the region of the closed end 5. Biting upon the mouthpiece 1 in this manner causes the top and bottom walls of the mouthpiece in the region of the closed end to move towards each other (and towards the diametral line joining the two protrusions 7).

Moving the top and bottom walls of the mouthpiece together causes the abutting surfaces of the valve closure elements to separate and further causes the valve closure elements,

due to their inwardly directed nature, to fold inwardly into the mouthpiece towards the internal wall thereof. Movement of the valve closure elements 11 in this manner opens the mouthpiece for the flow of fluid. If the fluid is under pressure, fluid will then flow through the mouthpiece in the direction of the arrow A into the user's mouth, but otherwise the user can draw fluid from the reservoir into his mouth.

When the mouthpiece is released, the top and bottom walls of the mouthpiece move apart and return to their original configuration. In turn, the valve closure elements return to their original configuration and close the valve.

The inwardly directed nature of the valve closure elements ensures that, up to the maximum pressure differential the valve is able to withstand, as the pressure differential across the valve closure elements increases, the abutting surfaces of the valve closure elements are corresponding urged more firmly together, thereby securely closing the valve to the flow of fluid.

Clearly the valve described with reference to the drawings can have alternative uses and configurations. For example, the valve can be used in fluid delivery systems for use by disabled persons and in medical applications.

With regard to alternative configurations, some alternatives have already been described hereinabove, but additionally the mouthpiece need not be circular in cross-section, but may be elliptical or any other suitable shape. Further, the shape of the mouthpiece may render the protrusions unnecessary to facilitate orientation of the valve. Moreover, the manner in which the fluid delivery tube is retained relative to the valve can be varied in dependence upon the relative size of the valve and the tube and upon the pressure differential that is to be accommodated.

CLAIMS

1. A valve made of a resilient material, the valve comprising a valve housing and at least two valve closure elements, wherein:

the valve housing is closed around the periphery thereof so as to define a flow path through which fluid passes through the valve;

the valve closure elements are secured to the valve housing in the region of the inner surface thereof and abut against each other in a closed position of the valve, the valve closure elements extending in the closed position of the valve over at least a portion of each valve closure element in a direction counter to the intended direction of flow of fluid through the valve,

the arrangement being such that on urging spaced peripheral portions of the valve housing towards each other, the valve housing is caused to deform resiliently and to move the valve closure elements over at least a portion of each valve closure element in a direction counter to the intended direction of flow of fluid through the valve, thereby causing the valve closure elements to become spaced from each other and to allow fluid to pass through the valve.

2. A valve as claimed in claim 1, wherein the valve housing is cylindrical.

3. A valve as claimed in claim 2, wherein the valve closure elements are positioned at or towards that end of the cylindrical housing remote from the intended fluid inlet thereof.

4. A valve as claimed in claim 2 or 3, wherein the housing is provided internally thereof with an annular recess for receiving an external collar of a fluid delivery tube.

5. A valve as claimed in claim 2, 3 or 4, wherein the valve housing has a relatively thin wall thickness in the region of that end of the housing remote from the intended fluid inlet thereof compared with the wall thickness of the housing in the region of that end thereof adjacent to the intended fluid inlet thereof.

6. A valve as claimed in any preceding claim, wherein the valve housing is provided with protrusions to assist alignment of the valve.

7. A valve as claimed in claim 6, wherein two diametrically opposed protrusions are provided.

8. A valve as claimed in claim 6 or 7, wherein the valve housing extends significantly in the intended direction of fluid flow and the protrusions are spaced from that end of the housing remote from the intended fluid inlet thereof.

9. A valve as claimed in any preceding claim, wherein two valve closure elements are provided.

10. A valve as claimed in claim 9, wherein each valve closure element is substantially semi-circular in section and is secured to the inner surface of the housing around the curved periphery of each valve closure element.

11. A valve as claimed in claim 9 or 10, when dependent upon any one of claims 6 to 8, wherein the protrusions are arranged such that they lie along a line substantially perpendicular to the straight line between the two valve closure elements.

12. A valve as claimed in any preceding claim, wherein the valve closure elements together form part of a conic surface.

13. A valve as claimed in claim 12, wherein the valve closure elements together form part of a sphere.

14. A valve substantially as hereinbefore described with reference to, and as shown in, the accopmanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -12-	Application number GB 9311445.2
Relevant Technical Fields (i) UK Cl (Ed.M) F2V (VP101, VP102) (ii) Int Cl (Ed.5) F16K 7/00, 7/04, 15/14, 15/18	Search Examiner MR M SIDDIQUE Date of completion of Search 12 SEPTEMBER 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-14

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2094443 A	(BLACK & DECKER) - Figure 2; page 1 lines 68-71, 96-105, protrusions 29 etc	1-3, 6-10, 12
X	GB 1490349	(GOOCH) - Figure 5, at least one set of tapering sides opposing direction of fluid flow etc	1, 2 at least
A	EP 0257880 A1	(VERNAY) - slit 20, portions of diaphragm 18 extending opposed to direction of fluid flow	1-3, 5, 13

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).